09/673327
430 Rec'd PCT/PTO 13 OCT 2000

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Translation of International Application WO 99/52657

Roll Stand with axially displaceable rolls

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The invention relates to a roll stand for hot-rolling or cold-rolling of rolled strips of different materials, including work rolls, back-up rolls and, optionally, intermediate rolls, wherein the rolls of at least one pair of rolls are axially displaceable toward both sides and have contours suitable for compensating rolling defects.

EP-B 0 091 540 describes a roll stand of the above type constructed as a four-high or six-high roll stand. In the four-high roll stand, the work rolls as well as the back-up rolls are axially displaceable relative to each other, wherein the displacement of the back-up rolls takes place either independently of or together with that of the work rolls. The six-high roll stand has work rolls which are supported by intermediate rolls which are supported by back-up rolls, wherein the work rolls and/or the back-up rolls and/or the intermediate rolls are axially displaceable relative to each other and the rolls of at least two pairs of rolls are provided with curved contours extending over the entire length of the roll bodies, wherein each curved contour is composed of a convex portion and a concave portion, and wherein the roll body contours of rolls which support each other or interact with each other support each other exclusively in a certain relative axial position of these rolls. The rolls are supported in sliding bearings which are mounted in chocks. The chocks are provided with sliding surfaces which slide on each other or on crossheads of the roll stand and are axially displaceable by means of push rods. The structural requirements for this construction are substantial.

The invention is based on the object of simplifying the axial displacement of the rolls of a roll stand as compared to the

solution with displaceable chocks.

The object is met by providing each displaceable roll with at least one hydrodynamic oil film bearing, wherein a hydraulic unit producing the axial displacement is integrated in the oil film bearing. Since, contrary to the sliding surfaces of the chocks, the rolls float on their hydrodynamic oil films in the hydrodynamic oil film bearings, the friction is slight even in axial direction. This makes it possible to axially position the rolls without problems and without transition and with the application of little force. The integrated hydraulic unit has a small structural size as compared to the previously conventional push rods and is a component of the roll bearing.

Because of the low friction of the bearing, the axial displacement can be carried out under load. Because the hydraulic unit requires little space, it can be used in all types of rolls (work rolls, back-up rolls and intermediate rolls).

The back-up roll is ground for hot rolling with a ground contour of the n-th degree. In the frontmost stands of a hot rolling train, the back-up roll is displaced in order to compensate the thermal crown of the work rolls, particularly during endless rolling. Presetting is carried out with the CVC work rolls.

In the rearmost stands, the displacement of the work rolls serves for evening out wear and thermal crown. The adjustment of the roll gap profile takes place by bending the rolls. The displacement of the back-up rolls in the rearmost stands increases the adjustment range for the preadjustment of the roll gap profile and is particularly useful in narrow, soft strips as well as in hard, wide strips.

The back-up roll is ground for cold rolling with a CVC contour for compensating x2-defects, in order to compensate planarity defects. The work rolls or intermediate rolls in the six-high stand have a CVC contour for compensating xn-defects.

In the six-high stand, the back-up roll has the CVC contour for compensating x2-defects, the intermediate rolls have the CVC contour for compensating the xn-defects, and the work rolls have means for compensating the edge drop phenomenon.

Since the hydraulic unit has an annular cylinder connected to the roll stand and an annular piston with an integrated ring connected to the roll, wherein the annular piston is sealingly guided in the annular cylinder, the hydraulic unit adapts particularly well to the shape of the hydrodynamic oil film

bearing. The diameter of the hydraulic unit is only insignificantly greater than the diameter of the bearing shell of the hydrodynamic oil film bearing.

A displacement of the rolls in both directions is possible because of the capability of applying pressure to both sides of the ring of the annular piston. The hydraulic oil for both directions of movement is alternatively supplied to the annular piston through the two hydraulic connections of the annular cylinder.

The position indicator serves for measuring the respective axial position of the axially displaceable rolls. This position is controlled by means of the hydraulic unit through the control circuit of the roll stand by utilizing the signals of the position indicator.

A particular advantage of the invention resides also in that the hydrodynamic oil film bearing with the hydraulic unit can be used as a retrofitting part. As a result, when retrofitting old plants, the existing chocks can be used. It is merely necessary to exchange the hydrodynamic oil film bearings. The pushing mechanism at the roll stand housing which requires space is unnecessary.

Further features of the invention result from the following

description and the drawing in which an embodiment of the invention is illustrated schematically.

The single Figure shows a longitudinal section of a hydrodynamic oil film bearing with hydraulic unit in the end position on the right hand side. Shown in the Figure is a roll stand housing 1 (or a chock) in which a bearing bushing 2 of a hydrodynamic oil film bearing 3 is arranged. The corresponding roll neck bushing 4 is seated with clamping cone on the roll neck 5 of a roll 6.

Attached to the roll stand housing 1 is an annular cylinder 7 in which an annular piston 8 is sealingly guided. This annular piston 8 is connected through conical roller bearings 9 to the roll neck 5. The annular piston 8 has on its circumference a ring 10 which is axially displaceable with the annular piston 8 in a groove 11 of the annular cylinder 7.

The groove 11 forms together with the annular piston 8 an annular space 12 which is divided by the ring 10. The portions of the annular space 12 are in connection with a control hydraulic system of the roll stand through separate hydraulic connections 13.

The free end of the roll neck 5 is covered in an oil-tight

manner by a cover 14. Attached to the cover 14 is a position indicator 15 which is connected through a connecting rod 16 to the free end of the roll neck 5. Annular cylinder, annular piston 8 and position indicator 15 form a hydraulic unit 17.

The arrangement according to the invention operates as follows: when an axial displacement of the roll 6 is required, hydraulic oil is applied to the right or left hydraulic connection depending on the desired direction of adjustment. This hydraulic oil acts, inter alia, on the annular surface of the ring 10 and thereby applies an axial force which is transmitted through the conical roller bearings 9 to the roll neck 5 of the roll 6. The axial displacement of the roll neck 5 is transmitted through the connecting rod 16 to the position indicator 15 which, in turn, controls the flow of hydraulic oil for achieving the desired roll position.

The arrangement according to the invention provides a simple, safe and space-saving axial displacement device which requires no maintenance because it is fully encapsulated. Because of these properties, the arrangement is also suitable for subsequent mounting in chocks of existing roll stands.